# INDUSTRIAL CHEMISTRY

## CHAPTER- DYES,

## DRUGS AND PHARMACEUTICALS

## ONLINE LECTURE

## NO. 1

## DATE:- 26, FEBRUARY 2021

## TIME: (10.00A.M.)

## a) Dyes: -

•**Introduction:** Natural colouring matters were known to mankind since ancient times. These colouring matters had plant as well as animal origin. e. g. Indigo a blue dye from Indigofera tinctoria and purple dye from glands of purple snail, Alizarin obtained from extract of roots of Madder plant. However, later on these natural colouring matters have been completely replaced by synthetic dyes. Now a day, most of the dyes are manufactured by synthetic methods from aromatic intermediate chemicals isolated from coal tar distillation and therefore the synthetic dyes are also known as coal dyes. The synthetic dyes have been proved to be much better and much cheaper than the natural colours.

**Definition of Dyes:** (Dyestuff): - "A stable colouring matter that can be applied in the form of solutions or dispersions to the substances for which they have affinity are called as dyes".

A dye is generally a coloured organic compound or mixture that may be used for giving colour to a substrate such as cloth, paper, plastic, leather, oils, food products etc. in a reasonably permanent fashion.

All the dyes may not necessarily be coloured substances. Therefore, optical brightners or whiteners which may be called white dyes may be included in the term dye. It should be clear that, every coloured substance is not a dye. e. g. Azobenzene is of orange red colour but, it is not a dye, because it is not capable of colouring fibre.

**Properties of a good dye: -**

1) It must have a suitable and attractive colour.

2) It must be able to attach itself to material from solution or to be capable of fixed on it. It must form a chemical union with the substrate.

3) It must be fast to washing, drycleaning, perspiration, heat, bleaching, ironing, friction, light and other agencies.

4) It must be resistant to chemicals like soap, washing soda, detergents, acids or alkalis.

5) It must possess high affinity and high dying rate. i. e. Must be able to absorb readily it from solution or aqueous dispersions.

**Colour: -** "The psychological sensation which is produced when the light of certain wavelength reaches the human eye is known as colour".

The ordinary light consists of electromagnetic radiations of different wavelengths which can be divided into various zones like X-ray, far UV, near UV, visible, near IR, far IR and microwaves. The human eye is sensitive to only a limited portion of electromagnetic vibrations producing light, from violet to red, called the visible region. The region associated with the radiations of wavelengths 400-800 nm is called visible region. This region is responsible for producing a definite colour to a particular substance to human eye.

When the beam of visible light strikes on the substance and if it transmits (or reflects) all the radiations, then the substance appears as white. While, when the substance completely absorbs all the radiations then it appears as black. The substance which absorbs the radiations selectively and reflects the unabsorbed radiations appears coloured.

Only reflected radiations are visible to us and hence the colour of the substance is the colour of the reflected radiations. Various compounds absorb different wavelengths of light and hence appear different in colour. The absorption of light depends upon the molecular structure of the compound. Thus colour of the compound depends upon chemical structure.

The visible light is composed of seven different colours namely violet, indigo, blue, green, yellow, orange and red. If a substance absorbs single band of white light, then in such case remaining six colours are reflected. If the substance absorbs all wavelengths except one single band say the blue, which is reflected, then the substance will appear blue. i. e. The substance will have the complementary colour of the absorbed band. Relationship between colour absorbed and complementary colour:

# INDUSTRIAL CHEMISTRY

## CHAPTER- DYES,

## DRUGS AND PHARMACEUTICALS

## ONLINE LECTURE

## NO. 2

## DATE:- 27, FEBRUARY 2021

## TIME: (10.00A.M.)

**Colour: -** "The psychological sensation which is produced when the light of certain wavelength reaches the human eye is known as colour".

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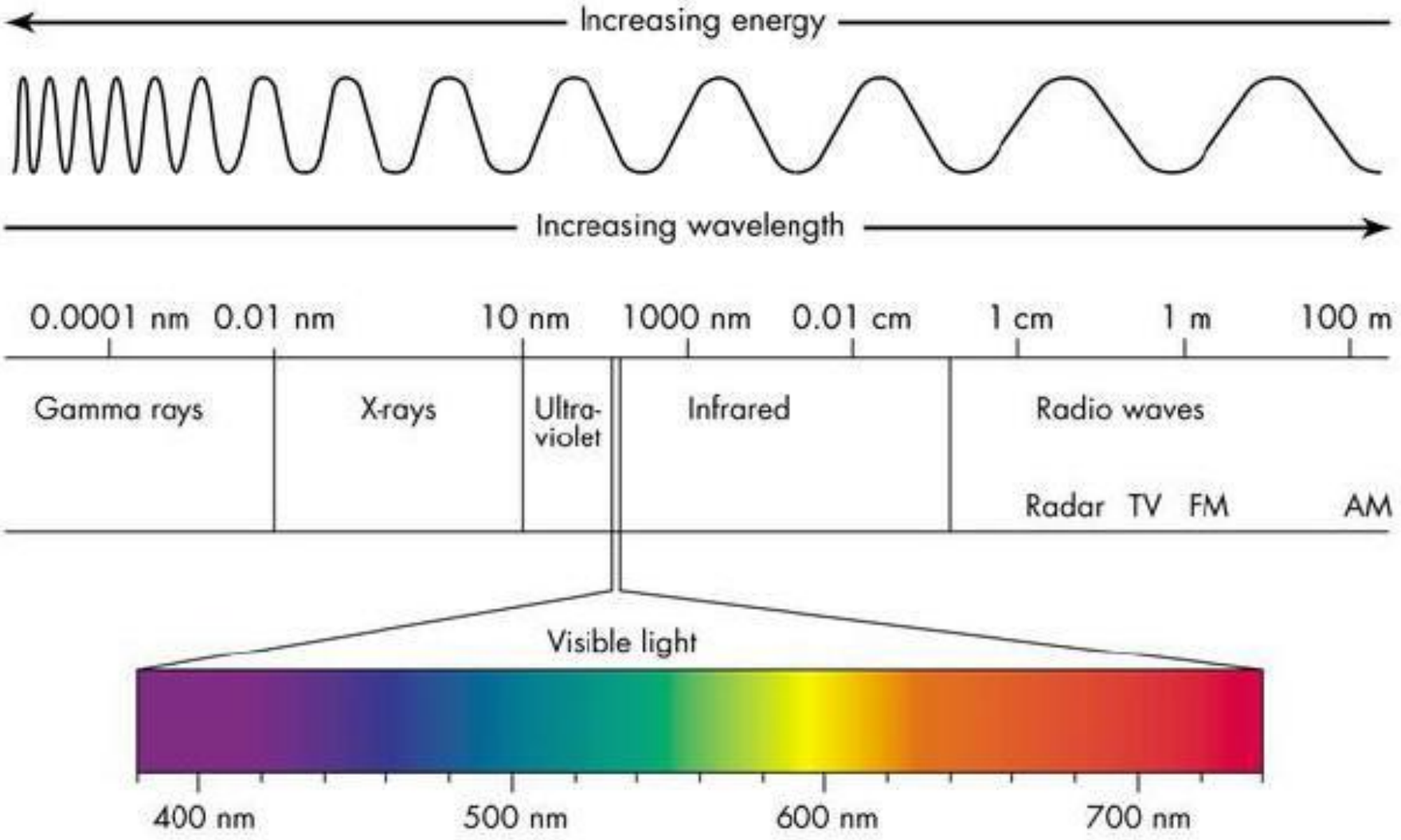


Electromagnetic spectrum

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| Wavelength absorbed (nm) | Colour absorbed | Complementary colour (observed) |
|---|---|---|
| 400-430 | Violet | Greenish yellow |
| 430-480 | Blue | Yellow |
| 480-490 | Greenish blue | Orange |
| 490-500 | Bluish green | Red |
| 500-565 | Green | Purple |
| 565-580 | Greenish yellow | Violet |
| 580-590 | Yellow | Blue |
| 590-600 | Orange | Greenish blue |
| 600-750 | Red | Bluish green |

Chromophores: - (Chroma means colour and phoras means bearing). i.e. Chromophores are colour bearing groups. The colour of organic compounds is mainly due to the presence of certain multiple bonded groups called as chromophores.

The intensity of colour increases with increase in the number of chromophores in a compound. The compounds containing a chromophoric group were called as chromogens.

A few important chromophoric groups are:

—N=O (Nitroso), —N=N— (Azo), —N=N→O (Azoxy), >C=S (Thiocarbonyl), >C=O (Carbonyl), —N=N—NH (Azoamino), —CH=N—(Azomethine), >C=C< (Ethylenic),

There are two types of chromophores: -

**1)** Independent chromophore: - A single chromophore is sufficient to impart colour to the compound is called as an independent chromophore. e. g. —N=O, —$NO_2$, —N=N, etc.

**2)** Dependent chromophore: - When more than one chromophore is required to impart colour, then it is called as dependent chromophore. e. g. Acetone containing one carbonyl group is colourless while, biacetyl, containing two carbonyl groups is yellow.

$CH_3$—CO—$CH_3$ (Acetone), $CH_3$—CO—CO—$CH_3$ (Biacetyl)

The shade of colour depends on the position of these chromophores. If they are separated by other groups, then the compound becomes colourless.

e. g. $CH_3$-CO-CO-$CH_3$ (Biacetyl) is yellow in colour, while $CH_3$-CO-$CH_2$-$CH_2$-CO-$CH_3$ is colourless.

Auxochromes: - (Auxein means to increase and Chroma means colour):

Certain groups which cannot produce colour themselves. But, when present alongwith the chromophore in an organic substance then they increase the intensity of the colour. Such colour assistant groups are called as auxochromes.

Auxochromes are either acidic or basic and generally salt forming groups such as —$NH_2$, —OH, etc.

e. g. Acidic:→ —OH, —$SO_3H$, —COOH.

Basic:→ —$NH_2$, —NHR, $NR_2$, etc.

Other examples are —Cl, —CN, —$COCH_3$, —$CONH_2$, —$OCH_3$, —$CH_3$, etc.

Auxochromes serves two functions: -

1) They increase the intensity of the colour. e. g. Benzene (no auxochrome) is colourless but Nitrobenzene (—$NO_2$ as chromophore) is pale yellow while, P-Nitroaniline (—$NO_2$ as chromophore and —$NH_2$ as an auxochrome) is dark yellow.

2) The fixing of the dye to the fibre is generally due to the formation of chemical bond between the fibre and auxochrome or by salt formation.

| e. g. $C_6H_6$ | $C_6H_5—N=N—C_6H_5$ | $C_6H_5—N=N—C_6H_4—NH_3^+.Cl^-$ |
|---|---|---|
| Benzene | Azobenzene | P-amino azobenzene hydrochloride |
| Colourless | Contain chromophore | Contain chromophore & auxochrome |
| No chromophore | But no auxochrome | (A dye, aniline yellow) |
| No auxochrome | (Coloured but not a dye) | |

A chromophore without an auxochrome cannot act as a dye.

# INDUSTRIAL CHEMISTRY

## CHAPTER- DYES,

## DRUGS AND PHARMACEUTICALS

## ONLINE LECTURE

## NO. 3

## DATE:- 15, MARCH 2021

## TIME: (10.00A.M.)

Auxochromes: - (Auxein means to increase and Chroma means colour):

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| e. g. $C_6H_6$ | $C_6H_5—N=N—C_6H_5$ | $C_6H_5—N=N—C_6H_4—NH_3^+.Cl^-$ |
|---|---|---|
| Benzene | Azobenzene | P-amino azobenzene hydrochloride |
| Colourless | Contain chromophore But no auxochrome (Coloured but not a dye) | Contain chromophore & auxochrome (A dye, aniline yellow) |

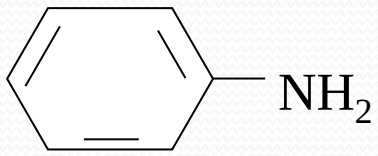
A chromophore without an auxochrome cannot act as a dye.

Types of Auxochromes:-

Mainly, auxochromes are of two types-

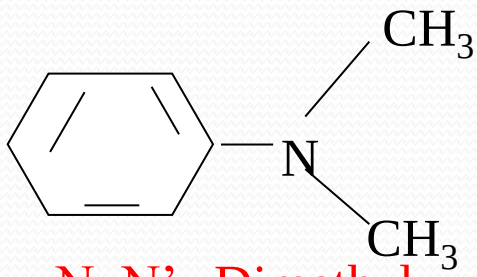
•Bathochromic groups: - These are the groups which increase the depth of the colour. The shift of absorption of colour from lower wavelength to the higher wavelength is called as a bathochromic shift. It is also known as red shift. When the H atom in an amino group is replaced by 'R' (Alkyl) group then a bathochromic effect is produced.

e. g. Distilled aniline is colourless, but N, N-dimethyl aniline has faint yellow colour.




Aniline

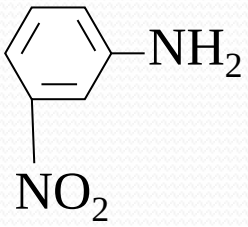
[Colourless]



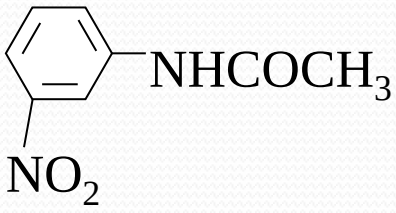

N, N' –Dimethyl aniline

[Yellow colour]

Hypsochromic groups: - These are the groups which decrease the depth of the colour. The shift of absorption of colour from higher wavelength to the lower wavelength is called as a hypsochromic shift. It is also known as blue shift. When the H atom in hydroxyl (-OH) or in an amino group (-$NH_2$) is replaced by an acetyl group then hypsochromic effect is produced. e. g. m-Nitroaniline is bright yellow, but its acetyl derivative is colourless.




*m*-Nitroaniline [Bright yellow]




Acetyl derivative of *m*-nitro aniline [Colourless]

# INDUSTRIAL CHEMISTRY

## CHAPTER- DYES,

## DRUGS AND PHARMACEUTICALS

## ONLINE LECTURE

## NO. 4

## DATE:- 22, MARCH 2021

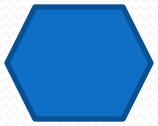
## TIME: (10.00A.M.)

## A relation between colour and chemical constitution:-

The colour of a compound is related to its chemical constitution as,

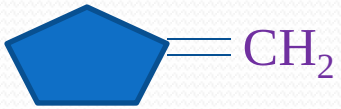
1) Benzene is colourless, while its isomer fulvene is coloured.

Benzene ($C_6H_6$)



Colourless

Fulvene ($C_6H_6$)




Coloured

2) Reduction of coloured compounds results in the loss of colour while, oxidation of the reduced compound regenerates the original colour.

Coloured organic compound $\underset{\text{Oxidation}}{\overset{\text{Reduction}}{\rightleftharpoons}}$ Colourless compound

$CH_2 = \overset{+}{N} = \overset{-}{N}$ $\underset{\text{Oxidation}}{\overset{\text{Reduction}}{\rightleftharpoons}}$ $CH_3 - NH - NH_2$

Diazomethane (Coloured)

Methyl hydrazine (Colourless)

Different theories have been proposed to establish a relationship between colour and constitution.

## Otto Witts theory (Chromophore-Auxochrome theory): -

In 1876, **Otto witt** put forth a theory as to correlate colour with molecular structure (constitution). The theory is named, "The Chromophoric Auxochrome Theory" (Witts Theory) and its main postulates are,

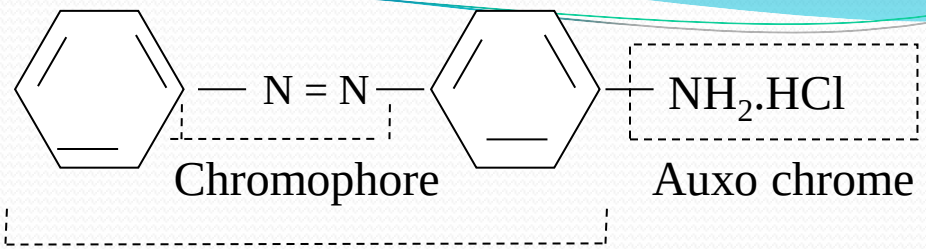
1) The color of the organic compounds is due to the presence of certain multiple bonded (Unsaturated) groups called as chromophores. Important chromophores are,

—N=O (Nitroso), —N=N— (Azo), —N=N→O (Azoxy), >C=S (Thiocarbonyl), >C=O (Carbonyl), —N=N—NH (Azoamino), —CH=N— (Azomethine), >C=C< (Ethylenic).

The presence of chromophore is necessary but not sufficient to produce colour. Because, it is not applicable to all unsaturated organic compounds. e. g. Benzene though unsaturated but it is colourless.

2) Certain groups which cannot produce colour themselves. But, when present alongwith the chromophore in an organic substance then they increase the intensity of the colour. Such colour assistant groups are called as auxochromes. Auxochromes are either acidic or basic and generally salt forming groups such as —$NH_2$, —OH, etc.

Then, Witts proposed that, the compound to be act as a dye must contain particular unsaturated group as the chromophore and the salt forming groups as the auxochromes. A chromophore without an auxochrome cannot act as a dye. Hence, it is called as chromophore-auxochrome theory. e. g.




*p*-Amino azo benzene hydro chloride

P-aminoazobenzene hydrochloride is a coloured compound and acts as a dye as it contains -N=N- (chromophore) and $-NH_3^+Cl^-$ (Auxochrome).

# INDUSTRIAL CHEMISTRY

## CHAPTER- DYES,

## DRUGS AND PHARMACEUTICALS

## ONLINE LECTURE

## NO. 5

## DATE:- 23, MARCH, 2021

## TIME: (3.00P.M.)

**Classification of dyes: -**

Dyes are mainly classified by two ways:

I) According to their mode of application to the fibre and

II) According to their chemical constitution

**I) According to their mode of application: -**

This classification is commercially very useful for dyers, because the application of dye depends on the nature of both, the fibre and the dye. Dying has always been carried out in aqueous solutions but recent work shows that various solvents like 1,1,1 trichloroethane may be used. The important classes of dyes according to their mode of applications are:

1) **Acid dyes: -** Dyes which are negatively charged and are used to bind to positively charged tissue components are termed as acid dyes. The colour of an acid dye is due to its negative ion. These are the sodium salt of sulphonic acid, carboxylic acid or phenolic compounds. Acid dyes have sulphonic, carboxyl or hydroxyl groups as their auxochromes. These are used to colour synthetic and natural polyamide fibres such as wool, natural silk, nylon, leather, paper from acidified solution. These dyes have no affinity for cotton, so these are not used to dye cotton. e. g. Naphthol yellow, Alizarin blue B.

2) **Basic dyes: -** Dyes which are positively charged and are used to bind to negatively charged tissue components are termed as basic dyes. The colour of the dye is due to positive ion. These are amino or substituted amino derivatives. In solvents other than water, they form writing and printing inks. These are generally used for duplicator inks, carbon paper and type writer ribbons. These are generally applied to paper, cotton, silk, and acrylic fibers. e. g. Methyl violet, Methylene blue, etc.

**3) Mordant or Adjective dyes: -**These dyes cannot dye animal and vegetable fibres directly. But, they need the presence of a medium or a third substance known as Mordant. The processing agent between cotton and dye is known as mordant. The basic mordants used for acidic dyes are metallic hydroxides of Cr, Al, Sn and Fe, The acidic mordants used for basic dyes are tannin or tannic acid. Mordant dyes contain –OH or –COOH radicals generally attached to azo or anthracene complexes. e. g. Alizarin.

**4) Direct or Substantive dyes: -** Some dyes are used in the textile industry to dye cotton without using a mordant and such dyes are termed direct dyes. Direct dyes are usually negatively charged. In other words, the coloured part of the molecule is the anion. Direct dyes are water soluble. These are the substances with high molecular weight and show colloidal properties. They become fixed on the fibre by hydrogen bonding. These are used to dye animal fibre, cotton and vegetable fibres. e. g. Congo red, Direct black, etc.

5) Vat dyes: - These are insoluble in water, but can be made soluble by reduction with sodium hydrosulphite and NaOH solution. The reduction is carried out in a large container and hence called vat dyes. The reduced form is absorbed on the fibre is usually white but when exposed to atmospheric air, leuco-vat is oxidized to give a coloured dye on the fibre. E. g. Indigo, Anthraquinone.

6) Sulphur dyes: - These are complex substances containing sulphur and are insoluble in water, but soluble in cold alkaline solution of sodium sulphide. These are dark in colour and expensive. Sulphur dyes are usually applied to cotton. After dyeing they are oxidized to air to get the original insoluble dye. e. g. Sulphur black or brown.

7) Reactive dyes: - These contain a reactive group (Cl atom). These dyes link chemically to cellulosic fibre. i. e. They form covalent bonds with fibres possessing –OH or $–NH_2$ group. e. g. Orange or azo dye.

8) Disperse dyes: - These are the non-ionic synthetic dyes used for polyester and related hydrophobic fibres. They are capable of penetrating or dyeing a fibre. The ethanolamine group $–NHCH_2CH_2OH$ is commonly found in these dyes and helps both in dispersion and absorption. These dyes are used to dye cellulose acetate, polyester, nylon, polyacronitrile fibres. e. g. Disperse yellow, disperse red.

9) Food dyes: - Food dyes are chemical substances that were developed to enhance the appearance of food by giving it artificial color. People have added colorings to food for centuries, but the first artificial food colorings were created in 1856 from coal tar. Nowadays, food dyes are made from petroleum. These are selected and tested for harmlessness. These dyes should be non-toxic and used in colouring foods, candles, confectionaries and cosmetics. They link at certain dyes to polymer chains and thus causing them to pass through the digestive tract unchanged. e. g. Anthraquinones, Azos and indigoids. Some natural dyes like turmeric, saffron, etc.

# INDUSTRIAL CHEMISTRY

## CHAPTER- DYES,

## DRUGS AND PHARMACEUTICALS

## ONLINE LECTURE

## NO. 6

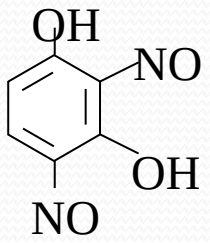
## DATE:- 23, MARCH, 2021

## TIME: (4.00A.M.)

## Classification of dyes according to their chemical constitution: -

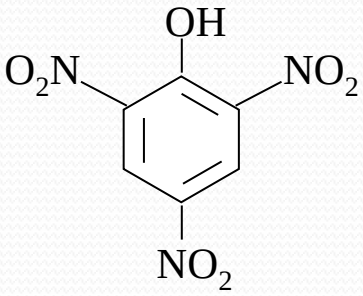
The classification of dyes according to chemical constitution are mainly classified on the basis of which chromophoric group is present in the molecule.

1) **Nitroso dyes: -** These dyes contain -N=O (nitroso) group or =N-OH group as chromophore and phenolic –OH group as auxochrome in the ortho position. They are obtained by the action of $HNO_2$ on phenols or naphthols. These are used in dyeing and cotton cloth (Calico) printing. E. g. Naphthol green Y, Naphthol green B.



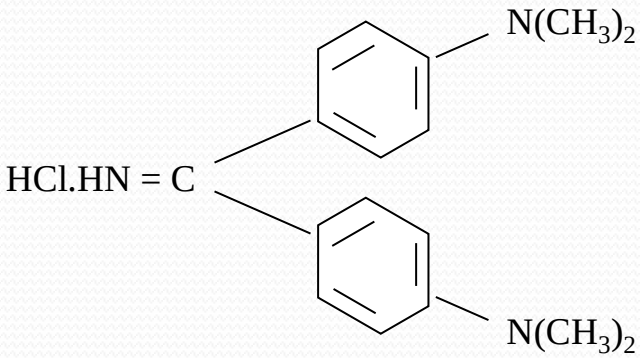

Fast printing green

2) Nitro dyes: - These dyes contain $-NO_2$ group as chromophore and –OH group as auxochrome. These are polynitro derivatives of phenol. These dyes are not very fast and hence have very little commercial importance. e.g. Picric acid (2,4,6 trinitro phenol), Martius yellow.

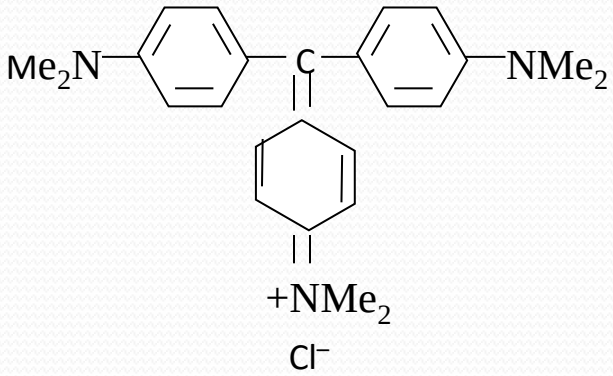



Picric acid

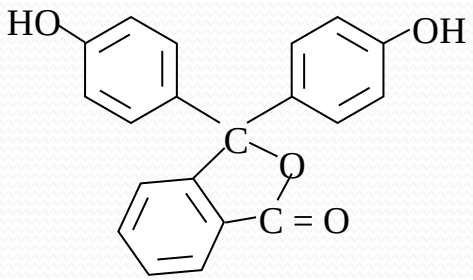
3) Diphenyl methane dyes: - These dyes contain NH=C< group as chromophore and also possesss a diphenyl methane nucleus. E. g. Auramin O.



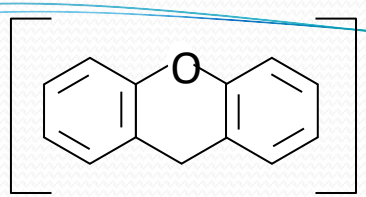
**4) Triphenyl methane dyes: -** These dyes contain quinonoid group as chromophore and the auxochromes may be $–NH_2$, -NHR, $-NR_2$ or –OH groups. In these dyes, the central carbon is bounded by three aromatic rings, one of which is in the quinonoid form. e. g. Crystal violet.



**5) Phthalein dyes: -** These are dihydroxytriphenyl methane derivatives with a carboxyl or sulphonic acid group ortho to the central carbon atom in the third phenyl ring. These are used as indicators e. g. Phenolphthalein.

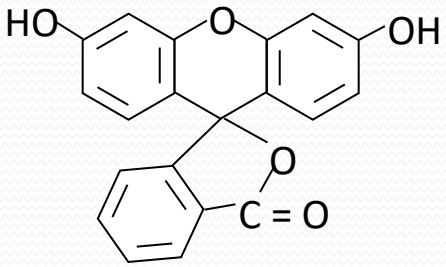


## 6) Xanthene dyes: -

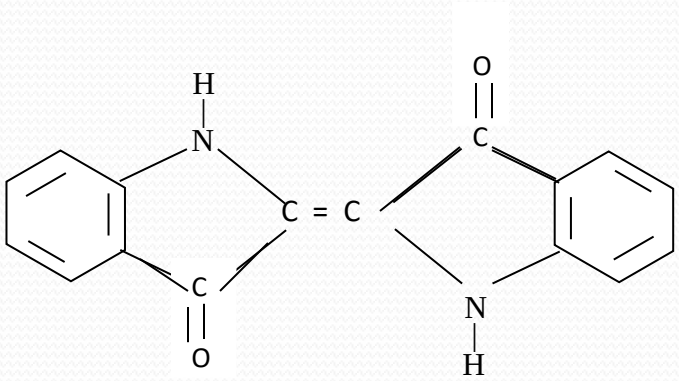



These dyes are obtained from xanthene by the introduction of auxochromes (-$NH_2$, -OH groups) at para position with respect to the carbon atom linking the two benzene nuclei. These are brilliant fluorescent dyes. e. g. Fluorescein, Eosin, Rhodamine.

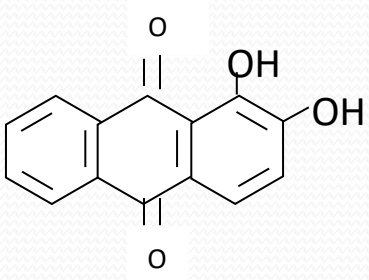
Fluorescein



**7) Indigoids dyes: -** Indigo is one of the oldest, naturally occurring in the plant of **indigofera** group and very well known dye. These dyes are characterized by >C=O group as chromophore and –NH group as an auxochrome. e. g. Indigotin.

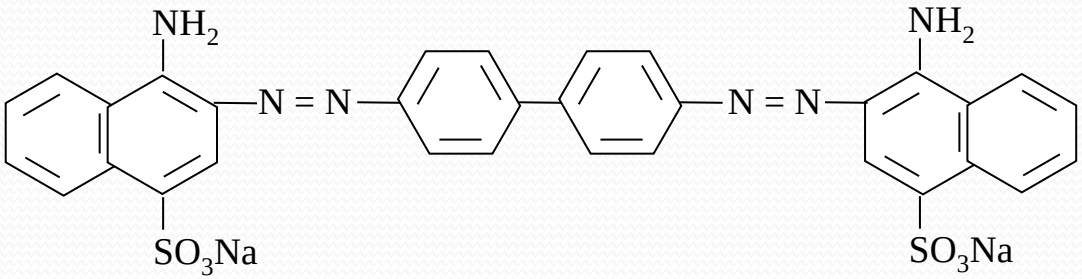


**8) Anthraquinone dyes: -** These are derivatives of anthraquinone and related polycyclic aromatic inones. In these dyes, chromophoric group is >C=O, while, auxochrome may be –OH, -$NH_2$ groups. e. g. Alizarin.



**9) Azo dyes: -** These dyes contain one or more -N=N- (AZO) group as chromophore and the $–NH_2$, $-NR_2$, -OH groups as auxochromes. Generally, azo dyes are prepared by coupling a diazonium salt with a phenol or an amine. They are highly coloured. These are of many types like Acidic azo dyes, Basic azo dyes, Direct azo dyes, Mordant azo dyes, Stilbene azo dyes, Ingrain azo dyes, Synthetic fibre dyes.

Congo red




**10) Phthalocyanine dyes:**

These dyes are generally metal complexes of isoindoles.

e.g. Copper phthalocyanine.

# INDUSTRIAL CHEMISTRY

## CHAPTER- DYES,

## DRUGS AND PHARMACEUTICALS

## ONLINE LECTURE

## NO. 7

## DATE:- 25, MARCH, 2021

## TIME: (10.00A.M.)

**b) Drugs and Pharmaceuticals: Introduction:** Many diseases are caused by attacking pathogenic organisms like bacteria, Protozoa, viruses, fungi, etc. A chemical which is capable of controlling the infection caused by such microorganisms is called a Chemotherapeutic agent, provided it is not toxic to the infected host. Drugs are chemical compounds which are used in the treatment and cure of specific diseases and they are also known as chemo therapeutic agents.

The term Chemotherapy means chemical treatment. According to Paul Enrilish, the term chemotherapy is used in the sense of treatment of parasitic diseases by chemical compounds, which destroy the microorganisms without serious effects on the tissues of the host (Patient).

Many compounds e.g. Formaldehyde, phenol, iodine, etc are also capable of destroying bacteria, but they also destroy the tissues of the host. Hence, these compounds are always used externally and that is why these compounds are not included under the heading of therapeutic agents. Such compounds are known as disinfectants.

**Drug: -** The word drug is derived from the French word 'drogue' which means 'dry herb' a plant used for food and medicine.

**Def.$^{n}$:-** "A drug may be defined as a substance with an abnormal effect on certain body functions".

Or "A substance used in the prevention, diagnosis, treatment or cure of diseases in man or other animals is called as drug".

According to world Health Organization (WHO), a drug may be defined as "Any substance or product which is used for modifying or exploring physiological system or pathological states for the benefit of recipient".

**Importance of drugs: -** The drugs are very important to promote and maintain good health for prolonging the life of man, to fight against sickness, pain and disease.

The main roles of drugs are diagnosis, cure, treat or prevent the disease. Hence, drugs are important for wellbeing of mankind and also for animal kingdom.

Pharmaceutical industry discovers, develops produces and markets drugs or pharmaceutical drugs for used as medication. The Indian pharma industry is highly organized sector. It is a quality producer of medicines and many units are approved by regulatory authorities of USA and UK. This industry provides large number of employments for manufacture and distribution of drugs. It is the 3rd largest in terms of volume and 13th largest in terms of value. India's Pharmaceutical exports stood at US 16.4 $ billion in 2016-17 and expected to reach US $ 20 billion by 2020.

**Qualities of good drugs: -**

1) A good drug should be harmful or toxic to the pathogenic microorganisms but, almost harmless (non-toxic) to the host. i. e. A good drug should have high potency but low toxicity.

2) A drug action should be localized at the site where it is required.

3) A drug should have minimum side effect.

4) The cells should not acquire tolerance or resistance to the drug after some time.

5) It should act in a system with efficiency and safety.

6) It should not injure host tissues.

7) It should not disturb physiological processes that are naturally occurring in the host body.

# INDUSTRIAL CHEMISTRY

## CHAPTER- DYES,

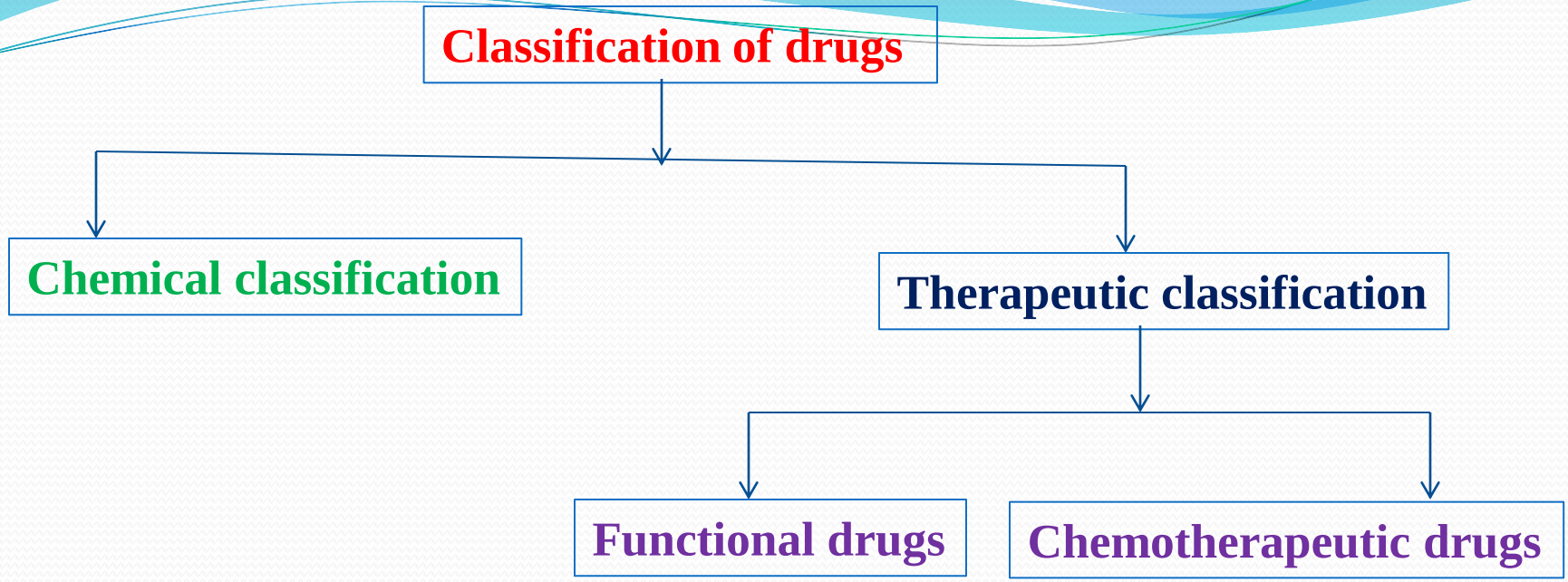
## DRUGS AND PHARMACEUTICALS

## ONLINE LECTURE

## NO. 8

## DATE:- 26, MARCH, 2021

## TIME: (10.00A.M.)


Classification of drugs
Chemical classification
Therapeutic classification
Functional drugs
Chemotherapeutic drugs

**Classification of drugs**: - Drugs can be classified into two ways:

1) On the basis of their chemical structure (Chemical classification)

2) On the basis of their medicinal uses (Therapeutical classification)

1) **Chemical classification:** - As per their chemical structure, it is only suitable for studying their chemical properties, synthesis, structure and so on.

2) **Therapeutic classification:** -According to this, the drugs are classified as per their medicinal use. These drugs are again classified as a) Functional drugs and b) Chemotherapeutic drugs.

**a) Functional drugs (Pharmacodynamic agents):** -These are the drugs which act on the various functions of the body. These drugs stimulate or depress various functions of the body, so as to provide relief from symptoms of discomfort. These are mainly used in non-infectious diseases to correct abnormal functions. e.g. Analgesic, anesthetics, anti-histamines, sedatives, etc.

**b) Chemotherapeutic drugs:** -These drugs are used in the treatment of infectious diseases (like malaria, tuberculosis, etc.). These agents are designed to kill the invading organisms without harmful effects upon the host. These drugs remove the cause of disease. Hence, these are bactericidal in nature. (When the drug completely kills the bacteria, it is said to be bactericidal).

These are further classified as-

1) Disinfectants: - They destroy microorganisms but not generally the bacterial spores.

2) Antiseptics: - These are compounds which suppress the growth of microorganisms.

The disinfectants and antiseptics both are applied externally.

3) Antibiotics: - These are chemical substances produced by microorganisms that can inhibit growth of other microorganisms or even destroy them. e.g. Penicillin.

**Meaning of the terms: -**

**Prescription: -** It is an instruction written by a medical practitioner that authorizes a patient to be issued with a medicine or treatment. A medical prescription is represented by a symbol $R_X$.

Prescription form is the text that include the name and address of prescriber (Doctor), registration number of doctor, name of patient etc. It may also include the order/instructions to be followed by patient, care taker, pharmacist or therapist.

**Doses: -** A quantity of medicine or drug taken or recommended to be taken at a particular time.

**Analgesic: -**These are the drugs which relieve pains in the body without the loss of consciousness. They are also defined as the drugs which act on the central nervous system, decrease the sensation of pain. These drugs only suppress the feeling of pain and not repair the cause of pain. e. g. Aspirin (Acetyl salicylic acid), Acetanilide, Novalgin, Brufen, Ibugesic.

**Antipyretics: -**These are the drugs which bring down the body temperature, whenever it is higher than the normal body temperature. They have no effect on normal temperature of the body. These drugs reduce the temperature of the body in fever. They control both fever and pain. e. g. Aspirin, Phenacetin, P-acetamol, Crocin, Metacin, Calpol, etc.

**Antibiotics: -**It is a substance produced by microorganisms (living cell) and has capacity of inhibiting the growth and even of destroying other microorganisms by the action of very small amounts. Antibiotics can be defined as the chemical substances derived from living cells which are capable in small concentrations of inhibiting the life processes or even destroying the microorganisms. They may be bacteriostatic or bactericidal in their activity. But they are useless against viral infections.

**Action of antibiotic is very specific.** i. e. given antibiotic has been found to be effective against certain type of microorganism only. e. g. Penicillin, Streptomycin, Chloromycetin, Erythromycin, Novomox, Novoclox, Ciprobid, etc.

**Anti-inflammatory: -** These drugs inhibit or reduce inflammation. These are of two types: Steroidal and non-steroidal drugs.

The steroidal drug provides very fast relief but have undesirable side effects. A steroidal drug has the capacity to prevent or suppress the development of the redness, swelling and tenderness by which inflammation is recognized. It is produced by adrenal (near kidney) cortex. e. g. Cortisol, dexamethasone, prednisolone.

Whereas non-steroidal drugs are bit slow but have comparatively less side effects. Certain non-steroidal compounds have been found to exert an analgesic and anti-inflammatory effect. e. g. Idicin, Microid, Iodomethacin, Inmencin, etc.

**Anti-viral: -** These drugs inhibit the development of viruses. These drugs are used for treating viral infections such as influenza, hepatitis, Covid-19, etc. But all antiviral are subjected to drug resistance by viruses and mutate themselves against antiviral over time. e. g. Zanamivir, Peramivir, Combivir, etc.

# INDUSTRIAL CHEMISTRY

## CHAPTER- DYES,

## DRUGS AND PHARMACEUTICALS

## ONLINE LECTURE

## NO. 9

## DATE:- 29, MARCH, 2021

## TIME: (10.00A.M.)

**Cardiovasculars: - (Cardiac drugs): -** Cardiovascular drugs are used to control or prevent certain form of heart disease/cardiovascular disease (the disease that involve heart or blood vessels). These drugs have direct action on the heart or other parts of the vascular system. They modify the total output of the heart or distribution of blood to certain parts of the circulatory system. e. g. Aten, Amlopin, Isrno, Digitoxigenin, Digitalis, Glycocide containing the aglyone, etc.

**Cold Preparations: -** These are mainly used in the treatment of the symptoms of cold. Cold can be defined a certain sets of signs of symptoms such as nasal discharge, nasal congestion, sore throat, headache, sneezing, loss of appetite, fever etc. They are generally a combination of a nasal decongestant. e.g. Febrex plus, Wicoryl, Phenyl-propanolamine, etc.

**Cough preparations: -** The drugs which relieve or prevent coughing are called as cough preparations. Cough is a phenomenon wherein irritating submucus and other excretions from respiratory track are expelled out. These drugs have good anti-tussive properties. e. g. TusQ-X, Benadryl, Codeine, Dextromethorphin, etc.

**Sedatives and Hypnotics: -** These are the drugs used to quiet patient, to produce drowsiness (sleepiness) and to relieve anxiety. A sedative is a substance that reduces sedation by reducing excitement or irritability. Sometimes, it may result in slurred speech, poor judgment, uncertain reflexes, walking difficulties etc. Sedatives are central nervous system depressants that reduce restlessness and emotional tension without producing sleep. e.g. Meprobamate.

Hypnotics are also central nervous system depressants that produce sleep to reduce restlessness and emotional tension. The patient cannot be easily awakened until the effect of the hypnotic wears out.

One cannot draw a definite line among hypnotics and sedatives. Usually, their action varies with the dosage. Hypnotics act very rapidly, while sedatives act gradually. e. g. Sulphonal, Veronal, Alprax, Restyl, Larpose and Phenobarbital.

**Contraceptives: - (Drugs for preventing Conception i.e. Pregnancy):-**

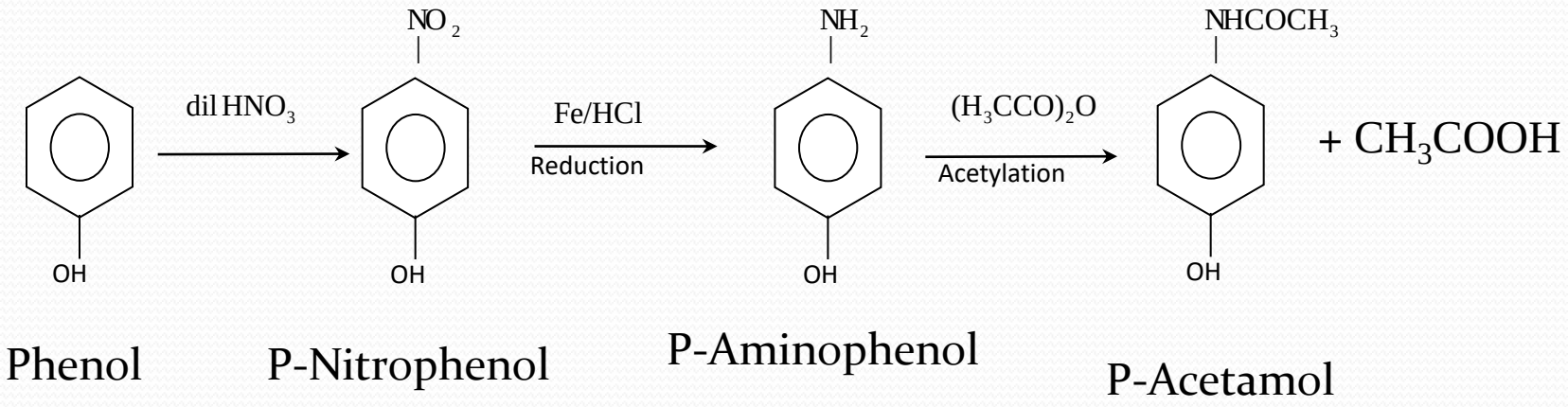
Contraceptive is a drug that prevents conception i.e. pregnancy. These drugs are the combination of a progestin and an estrogen and are found effective as an oral contraceptive. e. g. Enovid, Tricular, Overal-L, etc.

**Synthesis of Paracetamol: -** It is the acetyl derivative of P-aminophenol. Chemically paracetamol is p-acetyl aminophenol.

It is prepared from P-aminophenol by acetylation with acetic anhydride.

**From Phenol: -** Phenol on nitration by using nitric acid (dilute) gives *p*-nitro phenol.

It on reduction and subsequent acetylating by acetic anhydride give paracetamol.




Phenol P-Nitrophenol P-Aminophenol P-Acetamol

## Properties of Paracetamol; -

1) Its chemical formula is $C_8H_9NO_2$

2) Its molecular weight is 151.17.

3) Its melting point is 169 $^0$c

4) Its density is 1.263 g/cm$^3$.

5) Its solubility in water is 1.4 g/100 ml (20 $^0$c).

6) IUPAC name is N- (4-hydroxyl phenyl) acetamide.

## Uses of Paracetamol: -

1) It is used as an analgesic and antipyretic. (i. e. Pain and fever).

2) When combined with codeine, it is one of the major prescription drugs.

3) It can relieve headache, arthritis and muscular pain.

4) It is less toxic and has lesser side effects.

5) It is used as an intermediate in preparation of phenacetin (another antipyretic and analgesic).

**Synthesis of Aspirin: -** It is prepared from salicylic acid by acetylation with a mixture of acetic anhydride and acetic acid in presence of $H_2SO_4$.

It is synthesized from salicylic acid, salicylic acid when treated with acetic anhydnde in presence of sulphuric acid gives acetyl salicylic acid

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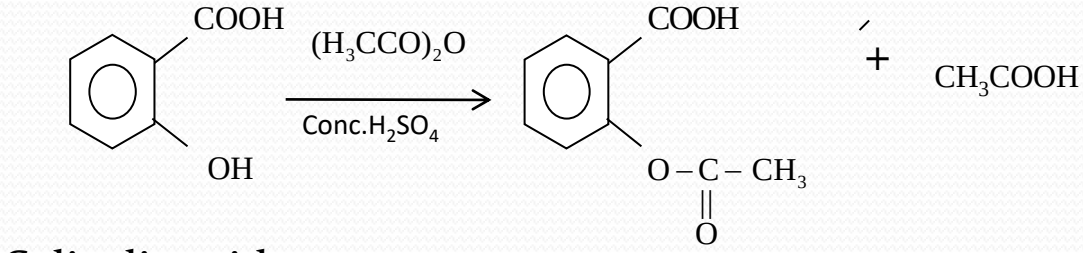



Salicylic acid

Aspirin
Or
Acetyl Salicylic acid

**Properties of Aspirin: -**

1) It is white crystalline powder with slight acid taste.

2) It is slightly soluble in water but, soluble in organic solvents.

3) It hydrolyses on contact with moisture to acetic acid and salicylic acid.

4) It also hydrolysed by enzymatic action in blood.

**Uses of Aspirin: -**

1) It is used as analgesic, anti-inflammatory and antipyretic.

2) It also has uricosuric (Substances that increase the extraction of uric acid in the urine, and reduces the conc. of uric acid in blood plasma) properties.

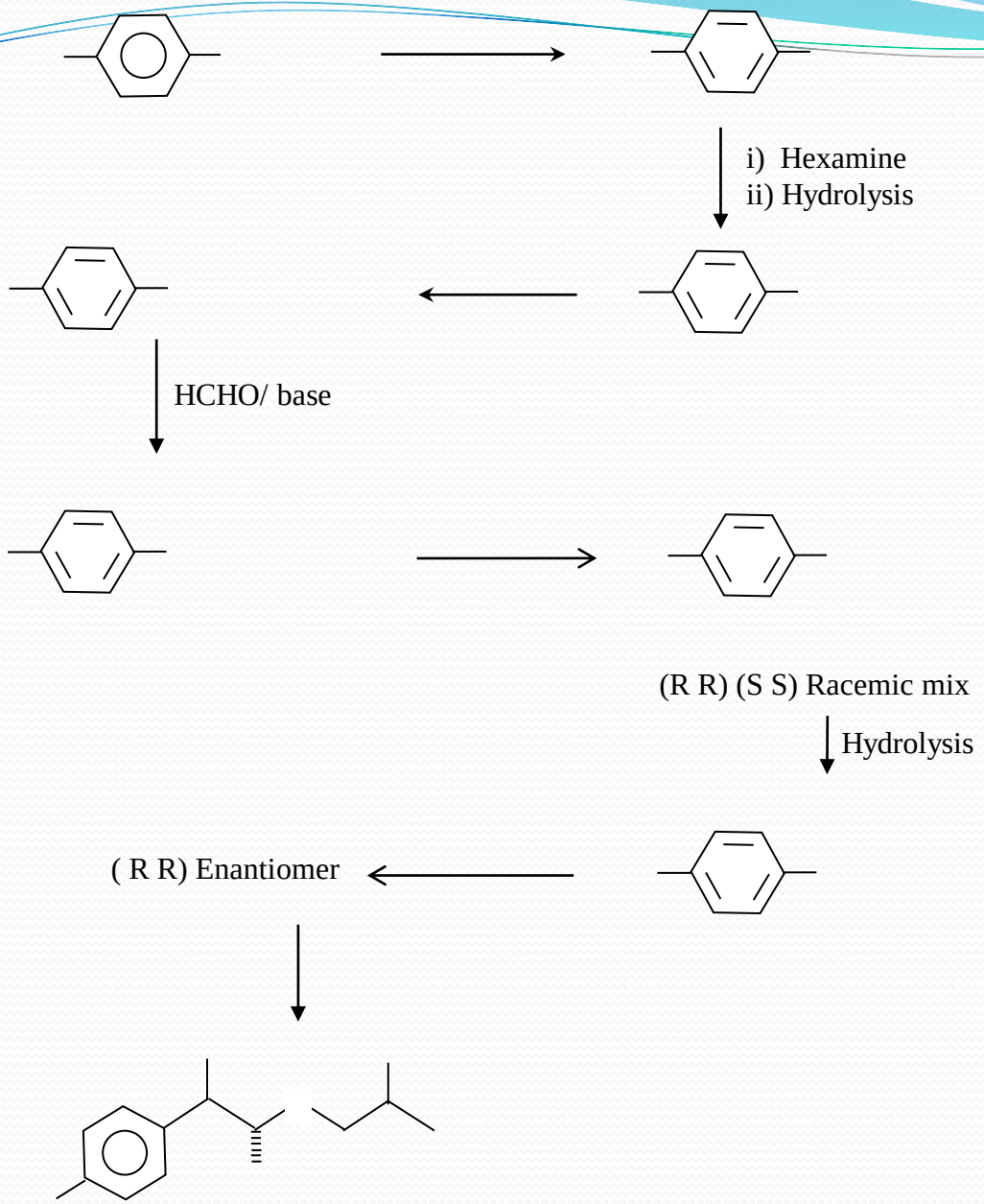
3) It is used to treat gout.

4) It is widely used to treat acute and chronic rheumatic states.

5) It is widely used to prevent heart attack and strokes.

## Synthesis of Chloramphenicol: -

Chloromycetin is commercially known as Chloramphenicol. It is synthesized in laboratories from P-Nitroacetophenone in sequence of steps. The synthesis of chloramphenicol indicates that the product is optically active which is resolved and chlorinated in fast step.




Chloramphenicol

**Properties of Chloramphenicol: -**

1) It is broad spectrum antibiotic effective against wide variety of gram positive and gram negative bacteria.

2) It is white to grayish yellow crystalline solid.

3) It has intensely bitter taste.

4) It is poorly soluble in water.

5) It is lipid soluble.

**Uses of Chloramphenicol: -**

1) It shows wide range antibacterial activity against gram positive aerobic microbes.

2) It is also used in eye drops or ointment to treat bacterial conjunctivitis.

3) It is very effective in treatment of typhoid.

# Thank You.

**STAY HOME,**
**STAY SAFE**